



Water Detectives



Purpose

To help students understand that there are many substances in the water which they can find using their senses and that there are other substances which they can only identify using tools

Overview

Students will try to identify substances in the water using their five senses. They will then use GLOBE instruments to detect substances in the water.

Time

One class period

Level

Beginning

Key Concepts

- Your 5 senses tell you about the world.
- Your senses detect different things.
- You use tools to help enhance your senses.

Skills

- Exploring answers to questions
- Developing answers to questions (hypotheses)
- Conducting an experiment
- Making observations
- Recording data
- Counting (or adding)

Materials and Tools

For each team of 4 or 5 students:

- 5 clear plastic cups or jars
- 5 plastic spoons
- Marker to number cups
- Items to detect in the water which represent all of the senses, such as:
 - Sight - drop of yellow food coloring, lemon juice, carbonated water
 - Touch - baking soda
 - Smell - lemon juice, vinegar
 - Taste* - salt, sugar, distilled water, tap water
 - Hearing - carbonated water
- Work Sheet
- * Use of taste is at the discretion of the teacher.

Preparation

Prepare the water samples for the experiment and duplicate the Water Detectives Work Sheet.

Prerequisites

None

Background

With an average runoff of 30 cm/yr, the hydrologic cycle constantly erodes the continents. A fraction of the eroded material is transported by rivers to oceans, both as suspended solids (e.g. sand, clays, and silts) and dissolved substances (e.g. salts). These can be considered as natural pollutants and can vary from dissolved limestone (calcium carbonate) to dissolved minerals that contain

heavy metals such as lead, cadmium, and zinc. Other substances are introduced into the hydrologic system through human activity. Oil, sewage, and chemical fertilizers and pesticides are examples. It is clear that if materials are being carried in the water, all forms of life using that water are subject to the effects of these substances.

Scientists have developed tests to see if various substances, whether harmful or beneficial,

naturally occurring or not, are found in water. These tests involve the use of tools to measure substances or properties that humans can not sense directly.

Preparation:

- Provide a work station with cups of water with small amounts of each 'mystery food' substance mixed in for each group (saltwater, carbonated water, etc.). Also provide tap water among the testing cups.
- Lay out spoons for dipping water to feel and to taste.
- Number the cups with the marker.
- Copy the Work Sheet for each student.

What to Do and How to Do It:

Discuss with students how they use their senses to detect things in their environment. Discuss the advantages and limitations of each of the senses. Questions students may want to think about:

1. How do we use our eyes to detect danger? When does our sense of sight not work very well? (*when something is out of vision range, in the dark, invisible...*)
2. How do we use our ears to detect danger? When do our ears not work very well? (*things that make no sound, when we do not listen or pay attention...*)
3. How do we use our sense of smell to detect danger? When does it not work very well? (*some things are odorless, when we have a cold...*)
4. How do we use our sense of touch to detect danger? When does it not work very well? (*when an object is far away, when touching might be dangerous...*)
5. How do we use our sense of taste to detect danger? When does it not work very well? (*when something might be poisonous or unclean...*)
6. Hold up a cup of water. Ask, which of your senses do you think would be most useful for finding out if the water was tap water for drinking? Consider the advantages and disadvantages of using each of your senses.

7. Do you think that just one of your senses would always work for finding out which of the cups contained tap water? Make a guess (hypothesis) as to which of your senses would most often detect mystery foods in the water. On your Water Detectives Work Sheet circle your guess from the pictures at the top of the paper.



Doing the Experiment

1. Show students the boxes of 'mystery food' which have been put in the water (salt, baking soda, etc.) Say, "These are foods that I have mixed into the water in front of you. We are going to use our senses to detect which of these foods are in the cups."
2. Have students look at the cups of water. Have them make an X on the Work Sheet next to the number of any cup that does not look like tap water. Put a W next to any cup that does look like tap water.
3. Have students listen to the cups of water. Have them make an X on the Work Sheet next to the number of any cup that does not sound like tap water. Put a W next to any cup that does sound like a cup of water.
4. Have students smell each cup of water. Have them make an X on the Work Sheet beside the number of any cup that does not smell like tap water. Put a W next to the cups that do smell like tap water.
5. Have students dip a few drops of water from each cup with the spoon to feel the water. Have them put an X on the Work



Sheet next to any cup that does not feel like tap water. Put a W next to any cup that does feel like tap water.

6. Have students dip a spoon in each cup of water to taste it. Tell them to use a clean spoon each time. Have them put an X on the Work Sheet next to the cups that taste different than tap water. Put a W next to any cup that does taste like tap water.
7. Have students count the number of X's under each sense. Which sense had the most X's? This is the sense that was best for detecting what was in the water.
8. Have students review which senses they thought were best for exploring water. Taste? Remind students that it was OK to taste the water today, but ask, "Would you want to taste water if you didn't know anything about what was in it?"
9. Ask students what other ways might be used to find out what was in water. Introduce the idea of how we use tools and ask for examples of how we use tools to help our senses. For example, they may think of smoke detectors, microscopes, hearing aids, etc.
10. Introduce students to pH paper as a tool for sensing water. Have students use pH paper to test their cups of water. What can the pH paper detect?

Note: A follow-up activity for pH is the pH Game. Students can explore different pH values of different substances found in their environment.

Adaptation for Older Students:

1. Have students use more advanced tests to determine differences in the water (alkalinity, conductivity, salinity or specific gravity).
2. Challenge students to devise their own tests for detecting differences in the water. (Example: shaking the water, adding other chemicals which might react with things in the water.)

Student Assessment

Ask students to:






- list several substances found in water
- explain why instruments are sometimes needed to detect substances
- guess (hypothesize) how various substances might affect things living in the water
- explain how each sense is good for examining different kinds of materials
- use the Work Sheet to record their (data) information and see how the work sheet can help them explain the results.

Further Investigations

Have students investigate whether different plants and animals like different types of water.

Water Detectives Work Sheet

Name: _____

Cup	See 	Hear 	Smell 	Feel 	Taste 	pH Test
1 one						
2 two						
3 three						
4 four						
5 five						
TOTAL						

Directions for Filling Out the Form

Under the column for each sense and in the row for each numbered cup, put an “X” in each box that represents a liquid that you think is NOT water. Put a “W” in the box that represents the liquid that you think IS water.

Be sure that you use only the sense that is listed in each column when making your decision. When you are done testing each sense for each cup look at the rows to see which one has the most W’s. That should be the cup with the water.